9) Calculate the percent filler content as follows:

$$\text{Filler Content, \% by weight (g)} = \frac{\text{Filler Wt. (g)} \times 100}{\text{Original Adhesive Wt. (g)}}$$

b. Filler Fineness

1) Determine filler fineness according to ASTM C 430, using No. 325 (45 µm), No. 200 (75 µm), and No. 100 (150 µm) sieves.
2) Modify this method by using a water-soluble, non-ionic wetting agent, such as Triton X-100, to aid the wetting action. Use a surfactant solution that is approximately 1 percent by weight.
3) Thoroughly wet the 1-gram dry sample in the surfactant solution.
4) Soak the sample for 30 minutes.
5) Transfer the filler to the sieve cup.
6) Spray water on the filler for two minutes.
7) Add surfactant solution as needed and physically disperse clumped particles.
8) Dry the sample and handle as directed in ASTM C 430.

The Department will reject any bituminous adhesive if it meets all requirements of this Specification but fails in actual use.

D. Materials Warranty

General Provisions 101 through 150.

Section 870—Paint

870.1 General Description

This section includes the requirements for all paints, including pigments, vehicles, and the compositions of prepared paints for all purposes specified.

870.1.01 Related References

A. Standard Specifications

General Provisions 101 through 150

B. Referenced Documents

QPL 46

SOP 14

AASHTO M 69

Military Specifications MIL-E-698 B

MIL-P-23236 or US Corps of Engineers Specification C-200

Federal Test Methods, Standard No. 141

Federal Specifications		ASTM			
TT-E-489	TT-P-791a	D 209	D 476	D 768	D 3021
TT-P-103b	TT-P-1952B	D 211	D 600	D 822	D 3721
TT-P-104b	TT-R-266	D 234	D 602	D 1199	D 4462
TT-P-320c	TT-T-291	D 235	D 604	D 1648	E 97
TT-P-460	TT-V-119	D 263	D 605	D 2805	G 23
		D 324	D 711		

870.2 Materials

A. Requirements

1. Ingredients

   The Engineer shall approve all paint ingredients. Mix the paints in the proportions specified in this section for each kind of paint. The formulas given represent the proportions by weight of the materials to be used.

2. Condition of Mixed Paints

   Ensure that mixed paints do not liver or curdle, and that the pigments remain in suspension to a reasonable degree satisfactory to the Engineer.

3. Filling and Packaging

   The manufacturer shall strain paints before filling the containers. The manufacturer also shall ship paints in strong, substantial containers (according to QPL 46) plainly marked with the paint name and number, color, volume, manufacturer name and address, date of manufacture, and the manufacturer's lot number on every package. The inspection stamp on the paint container will be evidence of approval.

   Traffic line paint manufactured for the Department shall be delivered in 55 gallon (208 L) drums. The manufacturer shall stencil on the head of each drum the kind of paint, requisition number, purchase order number, and gross and net weights. Ensure that the drums are the removable head types.

4. Finished Paints

   Unless otherwise specified, deliver paints to the Project or the Department completely mixed and ready for use without adding oils or thinner. Use well ground paints that do not settle or badly cake in the container, and can readily be broken up to a smooth, uniform paint with good brushing consistency.

   When brushed or rolled on a smooth, vertical surface, the paint shall dry hard and elastic without running, streaking, sagging, or spotting. Use paint for spray application that sprays satisfactorily and does not run, sag, or streak.

   The first coat of paint applied in the shop or in the field to uncoated structural steel or wood is called the primer coat. The paint covering the primer coat is called the second coat, and the paint covering the second coat is called the third coat.

B. Fabrication

The formulas given in this specification represent proportions by weight.

C. Acceptance

1. Testing

   Test methods for paint analyses shall be according to the Federal Test Methods, Standard No. 141 or the ASTM standard methods of tests for paint.

2. Color

   Match color visually by comparing with standard color chips obtained from the Office of Materials and Research.

3. Inspection

   Inspection and analysis will be made at the point of manufacture according to SOP 14. The manufacturer shall assist as necessary, permit the Inspector to test the ingredients before the paint is made, and witness the paint grinding.

   The Department reserves the right to sample and test all paint at any time before it is used.

4. Tolerances

   The Department will accept a tolerance of 1 percent of the required value for the paint formulation and property requirements.

   EXCEPTION: This tolerance does not apply where maximum and minimum values are noted.

D. Materials Warranty

The following people shall furnish the Department a certificate of analysis and manufacturer's guarantee:

- The manufacturer of each brand of paint submitted for acceptance under these Specifications
- All Contractors proposing to use any paint specified in this Section

Ensure that the certificate of analysis shows the paint trade name to be furnished, including a facsimile of the label if the paint is ready-mixed, and an analysis showing the percentage of each of the chemical elements and compounds in the pigment and vehicle. The guarantee shall assert that all paint furnished conforms to the analysis shown on the certificate

filed and to the statement of percentages of ingredients shown on the labels, which are required to be on each container. The guarantee shall be sworn to by a person having authority to bind the manufacturer into an agreement.

870.2.01 Paints for Structural Steel

A. Requirements

1. Use structural steel paint that meets the applicable requirements of Subsection 870.2 and the following:
   - No. 1A, Red Primer (see Table 1). Apply this paint with brush, roller, or airless spray.
   - No. 1W, Waterborne Red Primer (see Table 2).
   - No. 1 Z, Inorganic Zinc Rich Primer (See Table 3)
   - No. 2A, Buff (see Table 4). Apply this paint with brush, roller, or airless spray.
   - No. 2B, Aluminum (See Table 5 and Subsection 870.2.01.B, “Fabrication”).
   - No. 2W, Waterborne Intermediate Coat (see Table 6).
   - No. 3A, Brown (see Table 7). Apply this paint with brush, roller, or airless spray.
   - No. 3B, Green (see Table 8). Apply this paint with brush, roller, or airless spray.
   - No. 3W, Waterborne Green (see Table 9).

Table 1—No. 1A, Red Primer, Brushing, Roller, or Airless Spray Type

Requirement	Maximum	Minimum
Paint Composition, percent by weight		
Pigment	—	53
Vehicle	47	—
Coarse Particles, total residue retained on No. 325 sieve, based on paint, percent by weight	1.0	—
Fineness of Grind, North Standard	—	4.5
Viscosity, Krebs Units	81	75
Moisture Content, percent by weight	0.5	—
Drying Time, hours		
Set to touch	6	—
Dry through	18	—
Weight, lbs/gal (kg/L)	—	12.7 (1.52)
Pigment Composition, percent by weight		
Zinc Hydroxy Phosphite, ASTM D 4462	—	73
Red Iron Oxide ASTM D 3721	—	24
Organo Montmorillonite[1]	1.0	0.8
Vehicle Composition, percent by weight		
Non-Volatile[2]	—	66
Raw Linseed Oil, ASTM D 234		
Alkyd Resin Solution, Federal		
Specification TT-R-266, Type I,		
Class “A”		

Requirement	Maximum	Minimum
Thinners and Driers	34	—
Thinners, Federal Specification		
TT-T-291		
Driers, ASTM D 600 Class “C”		
Notes: ¹ Prewet Organo Montmorillonite with 20-30% (95%) methyl alcohol by weight. ² Ensure that the non-volatile vehicle is composed of 1:1 proportions by weight of raw linseed oil and alkyd resin, respectively.		

Table 2—No. 1W, Waterborne Red Primer

Requirement	Maximum	Minimum
Paint Composition, percent by weight		
Pigment	—	24
Vehicle	76	—
Coarse Particles, total residue retained on 60 µm sieve, based on paint, percent by weight	0.5	—
Fineness of Grind, North Standard	—	4
Viscosity, Krebs Units	100	90
Drying Time, hours		
Set to touch	3	—
Dry through	24	—
Weight, lbs/gal (kg/L)	—	9.85 (1.18)
Pigment Composition, percent by weight		
Red Iron Oxide	—	45
Zinc Phosphate	—	15
Vehicle Composition, percent by weight		
Non-Volatile Binder Solids, HG-54 or HG-56¹	—	30
Methyl Carbitol	—	5
Texanol	—	2
Dibutyl Phthalate	—	2
Other Additives	5	—
NOTE: ¹or approved equivalent		

Table 3—No. 1Z, Inorganic Zinc Rich Primer

Requirement	Maximum	Minimum
Zinc dust, percent by weight		
Zinc	—	99.00
Lead	0.6	—
Percent by weight of zinc in dried paint film	—	85
Elcometer Adhesion of dried paints, psi (MPa)	—	300 (2.1)
Note: The primer shall be self-curing and shall consist of two components, Zinc dust and Ethyl Silicate vehicle. A manufacturer's product data sheet and a material safety data sheet (MSDS) shall accompany each shipment of Inorganic Zinc Rich Primer. The product data sheet shall contain the following information for the mixed primer: Unit Weight, Viscosity, Volatile Organic Content (VOC), Pot Life, Percent Solids by Volume.		

Table 4—No. 2A, Buff, Brushing, Roller, or Airless Spray Type

Requirement	Max.	Min.
Paint composition, percent by weight		
Pigment	—	52
Vehicle	48	—
Coarse particles, total residue retained on No. 325 (45 µm) sieve, based on paint, percent by weight	1.0	—
Fineness of grind, North Standard	—	4
Viscosity, Krebs units	82	75
Moisture content, percent by weight	0.5	—
Drying time, hours	18	—
Weight, lbs/gal (kg/L)	—	12.5 (1.50)
Color: Match the Department's Standard Color Chip		
Pigment composition, percent by weight		
Zinc Hydroxy Phosphite, ASTM D 4462	—	75
Titanium Dioxide ASTM D 476 Type IV	—	19
Organo Montmorillonite—prewet with 20-30% (95%) methyl alcohol by weight	1.0	0.75
Tinting Pigments (may be added as predisperesed pigments):	3.5	3.0
Yellow Oxide ASTM D 768		
Red Iron Oxide ASTM D 3721		
Lampblack ASTM D 209		
Vehicle composition, percent by weight		
Non-Volatile, 1:1 proportions by weight, of: Raw Linseed Oil, ASTM D 234 Alkyd Resin Solution, Federal Specification TT-R-266, Type I, Class "A"	—	66
Thinners and Driers	34	—
Thinners, Federal Specification TT-T-291		
Driers, ASTM D 600 Class "C"		
Note 1: For the greatest effectiveness, the Organo Montmorillonite should be prewetted with 20 – 30% (95%) methyl alcohol by weight.		
Note 2: The non-volatile vehicle shall be composed of 1:1 proportions by weight of raw linseed oil and alkyd resin, respectively.		

Table 5—No 2B, Aluminum

Requirement	Maximum	Minimum
Paint Composition		
Aluminum Paste, AASHTO M 69, lbs (kg)	—	2 (0.24)
Aluminum Vehicle, AASHTO M 69, gal (L)	1 (1)	—
Drying Time, hours		
Set to touch	8	2
Dry through	24	—
Note: Refer to Subsection 870.2.01.B, “Fabrication”, for additional requirements.		

Table 6—No. 2W, Waterborne Intermediate Coat

Requirement	Maximum	Minimum
Pigment Composition, percent by weight		
Pigment	—	38
Vehicle	62	—
Coarse Particles, total residue retained on 60 µm sieve, based on paint, percent by weight	0.5	—
Fineness of Grind, North Standard	—	4
Viscosity, Krebs Units	100	90
Drying Time, hours		
Set to touch	3	—
Dry through	24	—
Weight, lbs/gal (kg/L)	—	11.0 (1.32)
Pigment Composition, percent by weight		
Zinc Phosphate	—	10
Calcium Carbonate	—	30
Magnesium Silicate ASTM D 605	12	—
Titanium Dioxide ASTM D 476 Type IV	—	40
Vehicle Composition, percent by weight		
Non-Volatile Binder Solid, HG-54 or HG-56[1]	—	30
Methyl Carbitol	—	5
Texanol	—	2
Dibutyl Phthalate	—	2
Other Additives	5	—
Notes: [1]or approved equivalent		

Table 7—No. 3A, Brown, Brush, Roller, or Airless Spray Type

Requirement	Maximum	Minimum.
Paint composition, percent by weight		
Pigment	47.0	45.0
Vehicle	55.0	53.0
Pigment composition, percent by weight		
Basic Lead Silico Chromate, ASTM D 1648	38.0	36.0
Red Iron Oxide—85%, ASTM D 3721	28.0	27.0
Titanium Dioxide, Rutile, Chalk Resistant, ASTM D 476, Type IV	16.5	15.5
Barium Sulfate, ASTM D 602	—	14.5
Organo Montmorillonite	—	0.6
Tinting Colors (Phthalocyanine blue, Lampblack, and Yellow Iron Oxide)	Remainder	
Vehicle composition, percent by weight		
Alkyd Resin, TT-R-266, Type I, Class A	—	57.0
Raw Linseed Oil, ASTM D 234	—	20.0
Mineral spirits, driers, antiskinning agents and methanol/water 95/5—prewet Organo Montmorillonite with 95/5 methanol/ water before adding to grind	23.0	—
Percent non-volatile vehicle	—	59.0
Color: Match Federal Standard Colors No. 595-30111		
Properties of finished paint		
Weight, lbs/gal (kg/L)	—	11.5 (1.38)
Viscosity, Krebs units	75	68
Fineness of grind, North Standard	—	4.0

Table 8—No. 3B, Green, Brushing, Roller, or Airless Spray Type

Requirement	Maximum	Minimum
Paint Composition, percent by weight		
Pigment	—	40
Vehicle	60	—
Coarse Particles, total residue retained on No. 325 sieve, based on paint, percent by weight	0.5	—
Fineness of Grind, North Standard	—	4
Viscosity, Krebs Units	85	75
Moisture Content, percent by weight	0.5	—
Drying Time, hours	8	—
Weight, lbs/gal (kg/L)	—	10.1(1.21)
Color: Shall match the Department's Standard Color Chip		
Pigment Composition, percent by weight		
Zinc Hydroxy Phosphite, ASTM D 4462	—	25
Titanium Dioxide, ASTM D 476, Type IV	—	2
Magnesium Silicate, ASTM D 605	45	40
Organo Montmorillonite[1]	1.5	1.2
Chromium Oxide, ASTM D 263	18	15
Pure Tinting Colors (No chrome green allowed)	Remainder	
Yellow Iron Oxide, ASTM D 768		
Red Iron Oxide, ASTM D 3721		
Lamp Black, ASTM D 209		
Phthalocyanine Green,[2] ASTM D 3021		
Vehicle Composition, percent by weight		
Non-Volatile	—	55
Alkyd Resin Solution, Federal Specification TT-R-266, Type I, Class "A"		
Thinners and Driers	45	—
Thinners, Federal Specifications, TT-T-291		
Driers, ASTM D 600 Class "C"		

NOTE: [1] Prewet Organo Montmorillonite with 20-30% (95%) methyl alcohol by weight.
[2] Chlorinated Copper Phthalocyanine, full strength, oil dispersable.

Table 9—No. 3W, Waterborne Green

Requirement	Maximum	Minimum
Paint Composition, percent by weight		
Pigment	—	15
Vehicle	85	—
Coarse Particles, total residue retained on 60 µm sieve, based on paint, percent by weight	0.5	—
Fineness of Grind, North Standard	—	4
Viscosity, Krebs Units	100	90
Drying time, hours		
Set to touch	3	—
Dry through	24	—
Weight, lbs/gal (kg/L)	—	9.35 (1.12)
Color: Shall match the Department's standard color chip		
Pigment Composition, percent by weight		
Zinc Phosphate	—	10
Titanium Dioxide, ASTM D 476, Type IV	—	5
Magnesium Silicate ASTM D 605	25	—
Calcium Carbonate	35	—
Pure Tinting Colors (No chrome green allowed)	Remainder	
Yellow Iron Oxide ASTM D 768		
Red Iron Oxide ASTM D 3721		
Lamp Black ASTM D 209		
Phthalocyanine Green ASTM D 3021		
Vehicle Composition, percent by weight		
Non-Volatile Binder Solids, HG-54 or HG-56[1]	—	30
Methyl Carbitol	—	5
Texanol	—	4
Other Additives	5	—
NOTE: [1]or approved equivalent		

B. Fabrication

1. No. 2B, Aluminum

   Prepare the aluminum paint by thoroughly mixing aluminum paste with mixing vehicle.

   a. Ensure the paints are well ground, do not settle or cake badly in the container, and are readily broken up to a smooth, uniform paint of good brushing consistency.

   b. Use 2 lbs (0.24 kg) of paste to 1.0 gal (1.0 L) of vehicle. Mix this at the factory.

   c. Ensure a thorough mix with a minimum of stirring. Ensure that the paint shows satisfactory leafing qualities and solidly covers in one coat without running, streaking, or sagging.

   d. If applying two coats of aluminum paint, tint the first coat with iron blue paste to help distinguish the two coats.

C. Acceptance

See Subsection 870.2.C.

D. Materials Warranty

General Provisions 101 through 150.

870.2.02 Traffic Line Paints

A. Requirements

Use traffic line paints that meet the applicable requirements of Subsection 870.2 and the following:

1. No. 4C, Black Traffic Line Paint
   a. Paint Composition: (See Table 10).
   b. Finished Paint:
      1) Flexibility: Ensure paint flexibility by following this procedure:
         a) Use a doctor blade or other suitable means to apply the paint to a 30-guage (0.39 mm) clean tin plate panel. Apply to a wet film thickness of approximately 2 mils (0.05 mm).
         b) Dry the panel in a horizontal position for 18 hours, and then bake it for 5 hours at 220 °F to 225 °F (105 °C to 110 °C).
         c) Cool the panel to approximately 77 °F (25 °C) and bend double over a ½ inch rod (13 mm rod). Ensure that the film does not show cracking or flaking upon bending or straightening.
      2) Color: Ensure that the paint dries to a pure, flat black and furnishes the maximum amount of opacity and visibility under both daylight and artificial light.

         Ensure that the paint does not discolor when exposed to weather or traffic and does not appreciably discolor with stains during service life on either concrete or bituminous surfaces.
      3) Weight per gallon (liter): Use paint weighing at least 14.0 lb/gal (67 kg/L) at 77 °F (25 °C).
      4) Consistency: The paint viscosity when measured at 77 ºF shall be 85 to 100 Krebs Units.
      5) Moisture content: The paint shall contain no more than 0.5% water.
      6) Drying**:** The paint shall dry to no pickup within 45 minutes when tested according to ASTM D 711.
      7) Spraying**:** The paint shall be factory-mixed ready for application through spray machines without using thinners.
      8) Storage**:** The paint shall not cake, liver, thicken, curdle, gel, or show other objectionable properties after storage for 6 months.
      9) Coarse particles and skins**:** The paint shall not contain more than 1.0 percent of coarse particles and skins.
      10) Fineness of Grind**:** The paint shall have a grind of 3 to 5 Hegman scale.
      11) Packaging**:** The finished paint shall be passed through a No. 40 mesh screen while filling the containers.

Table 10—No 4C, Black Traffic Line Paint

Requirement	Maximum	Minimum
Paint composition, percent by weight		
Pigment	43.0	41.0
Vehicle	59.0	57.0
Non-volatile vehicle, percent by weight of vehicle	—	42.0
Pigment composition, percent by weight		
Lamp Black, ASTM D 209	—	3.0
Calcium Carbonate, ASTM D 1199, Type GC (Note 1), Grade 1	34.0	32.0
Diatomaceous Silica, ASTM D 604, Type B	23.0	21.0
Magnesium Silicate, ASTM D 605	44.0	42.0
Organo Montmorillonite (Note 2)	0.8	0.3
Vehicle Composition, percent by weight		
Alkyd resin solution	—	70.0
Petroleum thinner, driers, and other additives	30.0	—
Alkyd Resin Solution Characteristics		
Type	Pure Drying Alkyd	
Type of oil	Soya, Linseed, or a mixture of the two	
Non-volatile, percent by weight	61	59
Volatile type	VM & P Naphtha	
Viscosity, Gardner-Holdt	Z^5	Z^3
Viscosity, at 45% solids	G	D
Color, Gardner—1953	10	3
Acid number, solids basis	8	—
Alkyd Resin Solution Characteristics,		
lbs/gal (kg/L) solution	7.75 (0.93)	7.66 (0.92)
Modifying oil iodine number (Note 3)	—	115
Phthalic Anhydride, percent by weight of non-volatile	—	33
Oil Acids, percent	55	48
Compatibility	500% in VM & P Naphtha	
Resin and/or Derivatives	None	
Phenolic Resin Modifiers	None	

Notes for Table 10:

1. You may use the following chemical composition requirements for calcium carbonate in lieu of those for Type GC. However, all physical properties prescribed for Type GC, Grade 1, are required.

Requirement	Maximum	Minimum
Moisture and other volatile matter, percent by weight	0.2	—
Total Calcium and Magnesium Carbonates, percent by weight	—	95
Magnesium Carbonate	3	

2. Prewet Organo Montmorillonite with 20-30% (95%) methyl alcohol by weight.
3. Use modifying oil acids, isolated by Federal Test Method No. 141, Method 7031 that have an Iodine Number as specified in Table 870.8, Alkyd Resin Solution Characteristics.

2. No. 5A, Waterborne White Traffic Line Paint
   a. Paint Composition: (See Table 11).
   b. Finished Paint
      1) Flexibility: Apply the paint to a 30 gauge (0.39 mm), clean tin plate panel, to a wet film thickness of approximately 2 mils (0.05 mm). Use a doctor blade or other suitable means.
         a) Dry the panel horizontally for 18 hours.
         b) Bake the panel for 5 hours at 220 ° to 230 °F (105 ° to 110 °C).
         c) Cool the panel to about 77 °F (25 °C) and bend it double over a 1/2 in (13 mm) rod. Ensure that the film does not crack or flake when bent or straightened.
      2) Bleeding: Ensure that the paint does not bleed over a bituminous surface type used in Georgia.
      3) Color: Ensure that the paint dries to a pure, intense white and furnishes the maximum amount of opacity and visibility under both daylight and artificial light.

         Ensure that the paint does not discolor when exposed to weather or traffic and does not appreciably discolor with stains during service life on either concrete or bituminous surfaces.
      4) Consistency: Use paint with a viscosity of 80 - 100 Krebs units at 77 °F (25 °C).
      5) Drying: Ensure that the paint dries to no-pick-up within six minutes when tested according to ASTM D 711.

         Ensure that the paint dries through within 20 minutes when applied at 15 mils (0.38 mm) wet thickness at 77 °F (25 °C).
      6) Spraying: Mix the paint at the factory so it can be applied by spray machines without adding thinners.
      7) Storage: Ensure that the paint does not cake, liver, thicken, curdle, gel, or show any other objectionable properties after storage for six months.
      8) Coarse Particles and Skins: Ensure that the paint contains less than 1 percent of coarse particles and skins.
      9) Fineness of Grind: Ensure that the paint has a grind of 2 to 5 Hegman scale.
      10) Weight per liter gallon: Use paint weighing at least 14.00 lb/gal. at 77 °F (1.68 kg/L at 25 °C).
      11) Packaging: Pass the finished paint through a No. 40 (425 µm) screen while filling the containers.
      12) Freeze-Thaw and Heat Stability: Ensure that the paint shows no coagulation, discoloration, or change in consistency greater than 10 Krebs units, when tested according to TT-P-1952B.
      13) pH: Ensure that the pH is greater than 9.5.

Table 11—No. 5A Waterborne White Traffic Line Paint

Requirement	Maximum	Minimum
Paint Composition, percent by weight		
Pigment	63.0	60.0
Vehicle	40.0	37.0
Non-Volatile Vehicle, percent by weight of vehicle	50.0	42.0
Pigment Composition, percent by weight		
Titanium Dioxide, ASTM D 476		
Type II, Rutile	—	13.0
Calcium Carbonate, ASTM A 1199		
Type GC Grade 1	87.0	—
Vehicle Composition, percent by weight		
Acrylic Emulsion E-2706 or DT211NA (50% NV)[1]	90.0	85.0
Methanol	3.0	1.0

Requirement	Maximum	Minimum
Texanol Coalsecent	5.0	4.0
Other Additives	5.0	0.0
Propylene Glycol	—	3.0
NOTE: [1] Or approved equivalent		

3. No. 5B, Waterborne Yellow Traffic Line Paint
   a. Paint Composition: (See Table 12).
   b. Finished Paint:
      1) Flexibility: Apply the paint with a doctor blade to a 30 gauge (0.39 mm), clean tin plate panel, to a wet film thickness of approximately 2 mils (0.05 mm).
         a) Dry the panel horizontally for 18 hours.
         b) Bake the panel for 5 hours at 220 ° to 230 °F (105 ° to 110 °C).
         c) Cool the panel to about 77 °F (25 °C) and bend it double over a 1/2 in (13 mm) rod. Ensure that the film does not crack or flake when bent or straightened.
      2) Bleeding: Ensure that the paint does not bleed on any bituminous surface type used in Georgia.
      3) Color: Ensure that the paint dries to a bright yellow that matches color chip #33538 of Federal Color Standard #595B, within the limits of the Highway Yellow Color Tolerance Chart.

         Ensure that the paint does not discolor when exposed to weather or traffic and does not appreciably discolor from stains during service life on either concrete or bituminous surfaces.
      4) Consistency: Ensure a viscosity of 80 - 100 Krebs units at 77 °F (25 °C).
      5) Drying: Ensure that the paint dries to no-pick-up within 6 minutes when tested according to ASTM D 711.

         Ensure that the paint dries through within 20 minutes when applied at 15 mils (0.38 mm) wet thickness at 77 °F (25 °C).
      6) Spraying: Mix the paint at the factory so it can be applied by spray machines without adding thinners.
      7) Storage: Ensure that the paint does not cake, liver, thicken, curdle, gel, or show any other objectionable properties after storage for 6 months.
      8) Coarse Particles and Skins: Ensure that the paint contains less than 1 percent of coarse particles and skins.
      9) Fineness of Grind: Ensure that the paint has a grind of 3 to 5 Hegman scale.
      10) Weight per Gallon (Liter): Use paint weighing at least 13 lb/gal (1.56 kg/L) at 77 °F (25 °C).
      11) Packaging: Pass the finished paint through a No. 40 (425 µm) screen while filling the containers.
      12) Freeze-Thaw and Heat Stability: Ensure that the paint shows no coagulation, discoloration, or change in consistency greater than 10 Krebs units, when tested according to TT-P-1952B.
      13) pH: Ensure that the pH is greater than 9.5.

Table 12—No. 5B, Waterborne Yellow Traffic Line Paint

Requirement	Maximum	Minimum
Paint Composition, percent by weight		
Pigment	63.0	60.0
Vehicle	40.0	37.0
Non-Volatile Vehicle, percent by weight of vehicle	50.0	42.0
Pigment Composition, percent by weight		
Titanium Dioxide, ASTM D 476 Type II, Rutile	—	4.0

Requirement	Maximum	Minimum
Lead-free organic yellow No. 65	—	5.0
Calcium Carbonate, ASTM D 1199 Type GC Grade 1	91.0	—
Vehicle Composition, percent by weight		
Acrylic Emulsion E-2706 or DT211NA (50% NV)[1]	90.0	85.0
Methanol	3.0	1.0
Texanol Coalsecent	5.0	4.0
Other Additives	5.0	—
Propylene Glycol	—	3.0
NOTE: [1]or approved equivalent		

B. Fabrication

General Provisions 101 through 150.

C. Acceptance

See Subsection 870.2.C.

D. Materials Warranty

General Provisions 101 through 150.

870.2.03 Sign Enamel

A. Requirements

1. Ensure that sign enamels, either baking or air-drying, except black, meet the requirements of Federal Specifications TT-E-489 and Subsection 870.2.
2. Use the identified class shown in Table 13 for the respective types. Also, ensure that each color matches Federal Standard 595A as designated.

Table 13—Sign Enamel Federal Specification Requirements

	Fed. Stand. No. 595 A	Fed. Spec. TT-E-489e	
Color	**Number**	**Class**	**Type**
Yellow	13538	B A	Baking Air drying
White	17875	B A	Baking Air drying
Red	11105	B A	Baking Air drying
Blue	15090	B A	Baking Air drying
Green	14109	B A	Baking Air drying

3. For a black sign enamel, use a semi-gloss enamel that matches Federal Standard Number 595 A, Color 27038 and meets the requirements of Military Specifications MIL-E-698 B and Subsection 870.2.

B. Fabrication

Prepare the surface and use a primer recommended by the manufacturer of the sign enamel.

C. Acceptance

See Subsection 870.2.C.

D. Materials Warranty

General Provisions 101 through 150.

870.2.04 Paint for Timber

A. Requirements

Ensure that paints for timber meet the requirements of Subsection 870.2 and Federal Specification TT-P-104b, unless otherwise specified.

1. If lead-free, fume-resistant paint is specified, ensure that it meets the requirements of Federal Specification TT-P-103b.
2. If chalking is a specified requirement, ensure that the paint meets Federal Specification TT-T-103b modified to require that the percentage of anatase be equal to that specified in TT-P-103b for both rutile and anatase.

B. Fabrication

General Provisions 101 through 150.

C. Acceptance

See Subsection 870.2.C.

D. Materials Warranty

General Provisions 101 through 150.

870.2.05 Miscellaneous Paints

A. Requirements

1. Paint for Steel Piling and Sway Bracing

   Use paint for steel piling and sway bracing that meets the requirements of Subsection 870.2 and the following:

   a. No. 1P, General: Ensure that materials used as a primer and/or finish coat are formulated from either a coal tar pitch or a native pyrobitumen resin. You may use other types of material if they meet the requirements in Table 14, below.

Table 14—Primer/Finish Coat Requirements

Properties	Requirements
Color	Black
Odor	Ensure coal tar materials have no pyridine, pyridine base, or tar acid odor.
Consistency	Easily applied by brush or spray to a coverage of 60 ft²/gal (1.5 m²/L), without sagging, yielding film thicknesses of about 26 mils (0.66 mm) wet and 13 mils (0.33 mm) dry.
Drying time	Apply at a rate of 60 ft²/gal (1.5 m²/L). Ensure that the material dries to a firm film within 24 hours at 70 ° - 80 °F (21 °- 27 °C) and can receive a second coat.
Chemical resistance	Ensure that the material remains intact and in good condition when immersed for 30 days in each of the following inorganic acids, alkalies, and salts: • 5% sulfuric acid • 5% hydrochloric acid • 2% phosphoric acid • 5% sodium hydroxide • 25% sodium chloride • 25% calcium chloride

   1) Durability: Before initially accepting a product to be supplied under this Specification, the complete system—from primer, when required, to finish coat(s)—shall be subjected to accelerated weathering and atmospheric exposure tests according to ASTM D 822 and ASTM G 23, Type D.

2) Ensure that the system remains intact without cracking, and prevents significant steel corrosion for at least 1,500 hours exposure in the accelerated weathering test, and 5 years atmospheric exposure in a coastal environment.

3) The State Materials and Research Engineer may approve systems that perform satisfactorily for up to 3,000 hours of accelerated weathering pending completion of the 5-year atmospheric exposure tests.

4) After the Department initially accepts the material, you do not need to test each lot of material. However, the Department will conduct other durability tests at its discretion.

b. No. 2P, Special Provisions Coating: Use special protective coatings instead of any other coating required by the Specifications for steel-H piling, steel sway bracing, metal shells for cast-in-place concrete piling, or prestressed concrete piling in all intermediate bents of the cap and pile trestle-type.

1) Get approval from the Laboratory for the protective coating material.

2) Use a two-component, chemically cured, coal-tar epoxy that meets the requirements of either Type I, Class 2, Military Specification MIL-P-23236 (Ships) or U.S. Corps of Engineers Specification C-200.

3) Ensure that the coating exhibits optimum chemical and physical resistance to alkalies and mineral acids under continuous immersion service.

4) Ensure that the cured coating withstands considerable physical abuse such as direct impact, abrasion, and flexing.

5) Furnish a written certification to the Engineer that the material meets the requirements of these Specifications.

2. Galvanizing Repair Compound

Use a compound that meets the general requirements of Subsection 870.2 and Table 15.

Table 15—Galvanizing Repair Compound Requirements

	Maximum	Minimum
Paint Composition, percent by weight		
Pigment	77	73
Vehicle	27	23
Pigment Composition, percent by weight		
Zinc dust, Federal Specification TT-P-460	99	95
Dust (Metallic Zinc Powder), Type 1 Lead Suboxide Stabilizer	0.15	—
Suspending Agent	1.85	—
Vehicle Composition, percent by weight		
Non-Volatile Vehicle	—	18
Volatile Vehicle	82	—

a. Non-volatile Vehicle: Use chlorinated rubber and a suitable plasticizer for the non-volatile portion of the vehicle. Ensure that the chlorine content, based on the non-volatile vehicle, is at least 60 percent by weight.

b. Volatile Vehicle: Use a volatile vehicle that is completely compatible with the other ingredients of the finished product. Ensure that the vehicle meets all the physical and chemical requirements of the end product.

c. Finished Compound: Ensure that the finished compound meets the requirements of Table 16.

Table 16—Finished Compound Requirements

Characteristic	Requirement
Condition in the container	No pigment component of the ready-mixed compound settles. When the package remains unopened for one year, you can readily disperse the pigment by hand mixing. The vehicle does not liver, curdle, or show excessive bodying.
Application	The material to repair galvanizing and to galvanize welds in the field shall be such that when applied, there is no unusual difficulty in horizontal, vertical, or overhead positions.
Adhesion	Expose test panels coated according to field application specifications to weather for at least 3 months in a position 45 degrees vertical, facing south. After this time, ensure that the test panels show no visible signs of peeling or flaking.
Gassing	No build up of gas or excessive pressure in the container when stored at room temperature for 3 months.
Dry film thickness	The compound leaves a dry film between 2 - 2-1/2 mils (0.051 - 0.064 mm) thick, when applied according to field application specifications.
Drying time	The compound is set to touch in 30 minutes and is dry to recoat in 4 hours. The material is thoroughly hard within 48 hours after application.
Hardness	Dry and cure the test panels coated under these Specifications for at least 48 hours. Brush a section by hand with a wire brush. Continue brushing until you see bright metal. Measure the dry film thickness. Accept the material if the brushing does not reduce the film below the specified thickness.
Consistency	Viscosity at 77 °F (25 °C) is 123 ± 7 Krebs units, as measured by the Stormer Viscometer.
Weight per lb (liter)	22 ± 10% lbs (2.64 ± 10% kg) at 77 °F (25 °C).
Packaging	Commercial paint packaging is acceptable for containers smaller than 1 gal (3.8 L). For 1 gal (3.8 L) packages, use No. 26 gauge steel pails. Do not pack more than 1 gal (3.8 L) of compound in a single container.
Storage	Store the compound where the temperature stays above 45 °F (7 °C).

3. Aluminum Caulking Compound

   Use a compound that meets the requirements of Subsection 870.2, third bullet, and Table 17.

Table 17—Aluminum Caulking Compound Requirements

Properties	Max.	Min.
Compound composition, percent by weight		
Pigment	—	72
Vehicle	28	—
Pigment composition, percent by weight		
Calcium carbonate, ASTM D 1199, Type GC	—	72
Mineral filler	17	—
Aluminum paste, Federal Specification TT-P-320c, Type II, Class III	—	10
Titanium Dioxide ASTM D 476, Type II, Class II	—	1
Vehicle composition, percent by weight		
Non-volatile	—	78.5

Properties	Max.	Min.
Refined vegetable oil	—	54
Polybutene oil	—	24.5
Fatty acid	—	3.5
Thinner and drier	18	—
Color: aluminum		

a. Other Properties

Properties	Requirement
Consistency	Can be applied by hand caulking gun, knife, or trowel.
Adhesion	Good adhesion to any dry, dust-free, or oil-free surface.
Curing	A light film forms in 48 to 72 hours. A tough metallic film develops in 2 to 3 weeks.
Exposure	Good resistance to water and weather.

B. Fabrication

General Provisions 101 through 150.

C. Acceptance

See Subsection 870.2.C.

D. Materials Warranty

General Provisions 101 through 150.

870.2.06 Miscellaneous Paint Materials

A. Requirements

Use other paint materials that meet the following requirements:

1. Raw Linseed Oil: Use oil that meets the requirements of ASTM D 234.
2. Boiled Linseed Oil: Use oil that meets the requirements of ASTM D260.
3. Turpentine: Use turpentine that meets the requirements of ASTM D 13.
4. Mineral Spirits: Use petroleum spirits (mineral spirits) that meets the requirements of ASTM D 235.
5. Spar Varnish: Use Varnish, Spar Phenolic Resin, as per Federal Specification TT-V-119.
6. Tinting Pigment Paste: Use lampblack, venetian blue, or iron blue as tinting pigments.
    - The Engineer may approve other tinting pigments, subject to limitations.
    - Add all tinting pigments in paste form.
7. Putty: Use putty that meets the requirements of Federal Specifications TT-P-791a, Type II.

B. Fabrication

General Provisions 101 through 150.

C. Acceptance

General Provisions 101 through 150.

D. Materials Warranty

General Provisions 101 through 150.